On the 20th a LOW in the vicinity of the Virginia Capes was responsible for heavy easterly to southerly winds along the American coast between Charleston and New York, while on the same day a second disturbance was central near latitude 48° N., longitude 37° W.

The western LOW moved northeastward along the coast and on the 22d was over Newfoundland. The second disturbance moved but little from the 20th to the 21st, but on the 22d surrounded the Azores. On the same date Horta recorded a barometer reading of 29.36 inches, while severe gales were reported from the vicinity, as shown by following storm log:

Italian S. S. *Dante Alighieri:*

Gale began on the 22d, wind SE. Lowest barometer 29.27 inches at 6 a. m. on the 22d, wind S., in latitude 37° 44′ N., longitude 25° 44′ W. End on the 23d, wind W.; highest force of wind 10; shifts SE.–S.

On the 23d and 24th moderate conditions were the rule over the entire ocean, with the exception of a few isolated localities where winds of gale force were encountered.

On the 25th a disturbance of limited extent was central near latitude 42° N., longitude 46° W., and strong northwesterly and northerly gales, accompanied by hail and snow, were reported by vessels in the southerly and westerly quadrants, respectively. This LOW apparently moved nearly due north and on the 26th was probably a short distance east of Newfoundland, although it was impossible to plot its position on account of lack of observations.

The daily weather map of the 26th showed a marked depression in the Gulf of Mexico that moved rapidly northeastward, being in the vicinity of Hatteras on the 27th, while winds of gale force swept the American coast from the Virginia Capes to the Bahamas.

On the 27th an area of low pressure was central near latitude 43° N., and longitude 35° W., and moderate gales were reported from the region immediately westward of the Azores.

On the 28th a LOW in the vicinity of the Bermudas was responsible for heavy winds in the southerly and westerly quadrants, and a few vessels in mid-ocean also rendered storm reports.

The British daily weather report for the 29th shows a well-developed depression central near Lerwick, Shetland Islands, and northwesterly winds of gale force were reported by a number of stations in the British Isles, while the few reports received from vessels near the coast indicated moderate weather only.

CYCLONIC DISTURBANCES IN THE SOUTH PACIFIC OCEAN

By ALBERT J. MCCURDY, Jr.

Weather reports received from vessels for February, 1924, indicate that stormy conditions prevailed in the South Pacific Ocean in the first and middle decades of the month.

On February 6 and 7 the American S. S. *W. J. Hanna,* Capt. Norman P. Forbes, proceeding from Talara, Peru, to Bahia Blanca, experienced fresh gales with overcast weather and rough seas. Mr. Vincent R. Cage, observer, states that the lowest pressure observed was 29.70 inches (uncorrected), occurring in the afternoon and night of the 6th, in 41° 21′ S., 77° 16′ W. The wind at this time was west, force 7. Similar conditions continued throughout the 7th.

The British S. S. *City of Naples,* Capt. H. Johnson, proceeding from Sydney to Panama, on February 11, while south of Cook Island, encountered a moderate southerly gale with heavy seas. Mr. R. C. Cooper, observer, states that the lowest pressure observed was 29.76 inches (corrected), occurring at 1 a. m. in 33° 15′ S., 158° 57′ W. The wind at this time was SSE., force 7. The gale ended on the 12th; wind S.

On February 19 winds of gale force were experienced by the British S. S. *Tahiti,* Capt. B. M. Aldwell, Wellington toward Sydney. Mr. J. C. Adams, observer, reports rough northeast seas with heavy rain. At 9 p. m., when in 35½° S., 155½° E., the barometric reading was 29.59 inches (corrected). The wind at this time was northerly, force 6, but later shifted to west and increased to a fresh gale at 1 a. m. on the 20th.

551.506 (265.2)

NORTH PACIFIC OCEAN

By WILLIS E. HURD

Much stormy weather, with a considerable amount of snowfall, prevailed along the northern trans-Pacific routes during February. Moderate to strong gales occurred daily over some portion of the sea, being most widespread perhaps on the 1st, 2d, 3d, 20th, 25th, 26th, and 28th. The highest force of the wind recorded was 11, whereas in January full hurricane velocities occurred on several occasions.

There is no record at hand of tropical storms in the Far East. In the western coast waters of tropical America the only gales of consequence were such as are typical of the region over and in the neighborhood of the Gulf of Tehuantepec. Here several vessels reported northerly to easterly winds of force 7 to 9 on the 5th, 8th to 10th, 20th and 21st of the month, accompanied by fine, hazy weather, with very little depression of the barometer, and rough seas.

In the Hawaiian region generally brisk trades prevailed. At Honolulu the wind velocities exceeded 25 miles an hour on 10 days, with a maximum velocity of 35 miles from the northeast on the 13th. The prevailing wind was from the east.

The average pressure at Dutch Harbor was 29.53 inches, based on p. m. observations, or 0.03 inch below normal. Such a comparison does not reveal the true pressure conditions at that station, however. Beginning with the 2d the pressure was continuously above normal through the 16th, a period of 15 days wherein the average daily departure was +0.51 inch. From the 17th until the end of the month pressure was continuously below normal, the average daily departure being −0.61 inch. The highest pressure, 30.34 inches, occurred on the 12th and 13th; the lowest, 28.18 inches, on the 25th. Absolute range 2.16 inches. At Midway Island the average pressure (28 days) was 30.08 inches, or 0.08 inch above normal. The highest reading, 30.28 inches, was recorded on the 22d; the lowest, 29.74 inches, on the 17th. At Honolulu the average p. m. pressure was 30.07 inches, or 0.03 inch above normal. The highest reading, 30.23 inches, was recorded on the 25th; the lowest, 29.77 inches, on the 16th.

The alignment of pressure conditions for the ocean as a whole showed the eastern North Pacific HIGH appearing in well-developed form on the first four days of the month. Thereafter until the 20th it was a weaker and more fluctuating area, sometimes cresting over the western portion of the United States or just off the coast, sometimes

ranging in a long narrow band along low latitudes, sometimes receding to the Aleutian regions, and on a few days scarcely in evidence. After the 20th, and until the close of the month it generally dominated the weather along the routes between Hawaii and the United States. Offshoots entered the continent on the 3d, 8th, 23d, and 28th.

In some portion of the area covering the Aleutians and the Gulf of Alaska low pressure continued throughout the month. Up to the 12th the LOW persisted to the eastward of Dutch Harbor, but a disturbance appeared to the westward on the 13th. This settled nearly over the central Aleutians where it remained generally until the 25th, although meanwhile several disturbances evolved from it and moved eastward. After the 25th it fluctuated considerably both eastward and northward, but on the 29th had two centers, one over the Gulf and the other again over Dutch Harbor. LOWS from this disturbed region entered the American Continent on the 5th, 7th, 10th, 12th, 13th, 16th, and 27th. That of the 16th gave the Weather Bureau station at North Head, Wash., a maximum wind velocity of 74 miles an hour from the south.

Very low barometric readings were made on several days over Alaska and the northern waters of the Pacific. On the 18th the British S. S. *Canadian Britisher*, in latitude 50° 36′ N., longitude 163° 15′ W., while in the nearly calm center of the great Aleutian cyclone of that date, had a pressure reading of 28.04 inches. This is the lowest recorded reading for the month. On the 22d, in 50° 23′ N., 155° 15′ W., the British S. S. *Empress of Russia* reported a minimum pressure of 28.19 inches. On the 23d the Canadian S. S. *Canadian Scottish* had a reading of 28.21 inches in latitude 51° 11′ N., longitude 157° 46′ W. On the 25th Kodiak had a low reading of 28.10 inches, and on the 26th Bethel, in southwestern Alaska, reported a pressure of 28.06 inches.

Remarkable pressure gradients occurred on the 18th and 26th. Between Eagle, Alaska, and the position of the *Canadian Britisher*, on the 18th, lay a pressure difference of 2.80 inches, the extremes being 28.04 and 30.84. The barometric range between Bethel, Alaska, near 61° N., 161° W., pressure 28.06, and the position of the American S. S. *Lurline*, in 35° N., 146° W., pressure 30.46, on the 26th, was 2.40 inches.

A report from the observer on board the American S. S. *Makaweli*, Capt. Elis R. Johanson, Seattle toward Hilo, is interesting in connection with the cross seas produced by opposing winds of force no higher than 4. He says:

> Saturday, February 23, 2:45 p. m., apparent position 33° 23′ N., 143° 42′ W. Heavy rain showers from SW. and NW. causing confused sea, as both winds were fighting against each other and raising waves like starting points of small waterspouts. Observed by master and second officer and commented on as a remarkable phenomenon, as the ship could actually feel the two winds, and the effects of both meeting were plainly visible over parts of the ocean.

Severe gales swept a considerable portion of the western half of the sea on the 1st to the 4th, and more moderate gales occurred on the 1st to the 3d between the 30th and 40th parallels from the 180th meridian eastward to the American coast. The storm conditions were most intense on the 1st and 3d.

On the 1st the American S. S. *Dilworth* was eastward bound in a southeasterly to southwesterly gale, force 11, lowest pressure 28.88, in 38° 14′ N., 171° 38′ E. On the 3d the American S. S. *China Arrow*, eastward bound, caught the extreme violence of the great cyclone in latitude 40° 15′ N., longitude 161° 46′ E. The lowest noted pressure was 28.45 inches. The observer reported, "Heavy mist and rain, storm to hurricane, mountainous seas." The Japanese S. S. *Horaisan Maru*, Kobe toward San Francisco, encountered the lowest pressure, 28.77 inches, highest wind force 11 SSW., in 39° 55′ N., 165° 34′ E. During the worst of the storm the "ship kept her head on SW'ard. Several other vessels in the vicinity experienced gales of force 10, among them the American S. S. *Bearport*, wind west, lowest pressure 28.50, in 44° 35′ N., 158° 11′ E., and the British S. S. *Canadian Freighter*, wind ESE., lowest pressure 29.13, in 46° N., 172° 30′ E.

On February 6 a cyclone left the northern China coast. By the 8th, with increased energy, the storm was crossing northern Japan, where a west wind, force 10, was observed at Nemuro. So far as our reports indicate, this storm diminished in severity shortly after entering upon the sea. The only report concerning it at this time is from the British S. S. *Shabonee*. This vessel during the 8th had moderate SSW. to NW. gales between 36° N., 144° E. and 40° N., 150° E., with lowest pressure 29.60 inches.

On the same date, in 44° 36′ N., 143° 30′ W., the American S. S. *Jadden*, westward bound, experienced a southwest gale, force 10, pressure 29.39 inches.

The next important cyclone to issue from the Asiatic continent was that of the 11th and 12th. On the first date a northwesterly gale, force 9, pressure 29.63, was noted by the American S. S. *William Campion*, in 34° 53′ N., 139° 42′ E. The storm moved into the ocean on the 12th and 13th, and by the 18th had added considerable energy to the Aleutian cyclone then central southeast of Dutch Harbor. Meanwhile, to the westward of the 180th meridian, rough weather and snow squalls occurred frequently, with occasional wind velocities attaining a force of 10.

Pressure remained low over northern Japan until the 28th, when anticyclonic conditions overspread the entire archipelago.

During the last decade of the month the days with severest weather over east longitudes were the 20th, 24th, 25th, 28th, and 29th.

On the 20th vessels as follows reported gales of force 10: American S. S. *Steel Traveler*, wind SW., pressure 30.02, in 31° 30′ N., 131° 02′ E.; American S. S. *Independence*, wind SW., pressure 29.49, in 32° 12′ N., 151° 30′ E.; American S. S. *West Ivan*, wind N., pressure 29.48, in 32° 25′ N., 154° E.

On the 24th the American S. S. *President Madison* ran into a westerly gale, force 10, pressure 29.31, in 42° 05′ N., 152° 32′ E.

On the 25th the American S. S. *Java Arrow*, eastward bound, fell into a westerly gale, force 10, pressure 29.36, in 39° 56′ N., 166° 20′ E.

During the 23d to 26th the American S. S. *Stockton*, Manila toward Portland, Oreg., experienced almost constant gales, mostly from the west and northwest, between 39° N., 155° E. and 46° N., 172° E. Continuous precipitation occurred during this period, mostly as rain, but with frequent snow squalls. The highest wind force was 9, lowest pressure 28.87, in 44° 05′ N., 165° 20′ E., on the 25th.

On the 28th and 29th the last Japanese disturbance of the month swept with increasing power upon the Pacific. Report is at hand from only one vessel in this area. The American S. S. *West Kader*, westward bound, while in 42° 45′ N., 152° 30′ E., passed through the extreme violence of this cyclone, breasting a westerly gale, force 11, minimum pressure 29.26 inches.

In west longitudes, during the last decade, the Aleutian cyclone also was productive of strong wintry gales, the greatest violence of which occurred on the same days as to the westward of the 180th meridian.

On the 19th and 20th the American S. S. *Carriso*, Manila toward San Francisco, near 43° 40′ N., 146° 30′ W., encountered whole westerly gales, lowest pressure 28.69, late on the 19th. On the 20th the British S. S. *Tyndareus*, in 50° 06′ N., 141° 46′ W., experienced its lowest pressure, 28.71 inches, in the same storm. Quoting from the observer:

3 a. m., wind veered to ESE. 7. 4 a. m. SE. 8, lowest barometer. 5 a. m., veered to SSE. 8. 6 a. m., veered to S. 8. 8 a. m., wind increased to force 10. Noon, wind veered to SSW. 8. 8 p. m., wind and sea decreasing.

On the 24th and 25th, the storm center was very near Dutch Harbor, but the cyclone was of great dimensions. The Canadian S. S. *Canadian Scottish*, in 53° 57′ N., 139° 44′ W., experienced the highest wind force, 11 from the southwest. The American S. S. *President Jackson*, in 50° 55′ N., 156° 30′ W., encountered a south to southwest gale, force 11, lowest pressure 28.12 inches.

On the last two days of the month, with the cyclone central over the northern Gulf of Alaska, the American S. S. *Eldridge* experienced whole gales to storm winds from westerly directions, the lowest pressure noted being 28.68, in 49° 42′ N., 153° 20′ W., on the 28th.

Fog occurred along the northern and middle steamship routes on several days, but was not so frequent as during January, except along the American coast between 25° and 50° N. Here it was particularly frequent between 30° and 40° N., where it was observed on 30 or more per cent of the days.

From the standpoint of the seaman the rough weather of February resulted principally in delays between ports, many vessels being compelled to slow engines for hours at a time in the face of enormous or greatly confused seas.

551.516(73)

DETAILS OF THE WEATHER IN THE UNITED STATES

GENERAL CONDITIONS

By ALFRED J. HENRY

A dry month everywhere, except locally in the State of Washington, in the Missouri Valley, the Gulf States and the Lake region. Dry weather continued in Oregon and California.

Temperature was above the normal in the Northwest and below in the Southeast, the dividing line between the two areas running northeast-southwest from west Texas to the Lake region. The usual details follow.

CYCLONES AND ANTICYCLONES

By W. P. DAY

Low-pressure areas were about normal in number, but included a large proportion of secondary developments over the South and Southwest. There were an unusual number of large and sluggish high-pressure areas. These HIGHS occupied the northern interior districts for days at a time and probably prevented the normal eastward drift of the LOWS and favored the development of secondaries over southern districts. These southern LOWS were also affected and showed numerous abnormal movements. In other words, there was a more or less continuous outflow of cold air from the northern interior with somewhat abortive attempts on the part of the warm air to pierce this front, at least over the continental areas.

FREE-AIR SUMMARY

By L. T. SAMUELS, Meteorologist

There are shown in Table 1, the monthly mean temperatures, relative humidities and vapor pressures together with the departures from normal and in Table 2, the resultant wind directions and velocities and the normals. The large positive temperature departures at all levels at Ellendale are conspicuous while practically the opposite condition is found at Due West. The very excellent agreement between the temperature departures found for the various kite stations and those shown in Climatological Chart III is of particular interest in that it indicates the close approximation to the true average monthly temperatures as determined from the daily maxima and minima of surface observations and those found at the average time of kite flights.

The resultant wind directions at Drexel and Ellendale showed the largest deviation from the normals, there being a very pronounced north component in the monthly means. This, it may appear, is somewhat in conflict with the fact that these two stations showed the largest positive temperature departures, but it will be observed that the resultant velocities for the month at these stations were considerably less than normal. It is further probable that in a number of cases the northerly winds at these stations were not necessarily relatively cold winds but as was indicated in the free-air summary for January, 1924, may have followed a curved path and originated over a relatively warm region.

As a rule a well-developed LOW is accompanied, not only by considerable cloudiness, but at least in certain quadrants by more or less widespread precipitation as well, thereby making it impracticable to secure within its confines good kite or pilot-balloon observations. On the morning of the 3d, however, there appeared a deep LOW central over the lower Missouri Valley which in the second respect differed from the average. For this reason it seems advisable to relate in some detail the characteristics of the upper atmosphere as shown by aerological observations during the eastward advance of this storm. Its movement across the country was conspicuously slow, the center being over the lower Lakes three days later. The precipitation area increased rapidly, however, after the 3d, but fortunately good kite observations were obtained during the most of this period, some of these being made during snow flurries. The times of these observations were approximately the same as indicated by the morning weather charts so that reference to the latter is suggested in order to locate the position of any particular station relative to the storm center.

Attention is first invited to the "flat map" of the 2d with respect to both pressure and temperature gradients (not reproduced). The free-air temperatures on this day exhibited the same characteristics, there being practically no temperature difference between Drexel and Groesbeck from 1,000 to 4,000 m. It seems probable that this fact played a part in the rapid development of thd LOW as found the next morning. On the next day (3d) all of the kite stations except Due West were within the boundaries of this storm and fortunately all stations